

exceptionally heavy rains in New York and New England. On the 9th and 10th violent electrical and rainstorms prevailed throughout the Southwest, in connection with low area II, and in Missouri and Oklahoma and Indian Territories small streams were flooded and damage was caused to property. From the 13th to the 15th heavy rainstorms and high winds occurred in the lower Missouri Valley and heavy rains during the succeeding three days caused floods in the smaller streams of eastern Kansas and Missouri that flooded thousands of acres of corn fields in bottom lands. Flood stages for which warnings were issued occurred in the Missouri River east of Kansas City, and in the middle Mississippi River south of the mouth of the Missouri.

Frosts occurred in Missouri and Wisconsin on the 13th and in Michigan and New York on the 14th. High wind during the night of the 13-14th is reported to have saved the Cape Cod cranberry crop from destruction by heavy frost. On the morning of the 14th frost was forecast for the morning of the 15th in the cranberry bogs of New Jersey and considerable damage by frost is reported to have been caused, the morning of the 15th, to cranberries in some parts of the New Jersey district.

Snow was reported in the mountain districts of Vermont on the 13th, in the Adirondacks on the 15th, and in the mountains of Colorado on the 18th. Six inches of snow was reported on Mount Washington on the 25th.

BOSTON FORECAST DISTRICT.

The month, as a whole, was wet and cool. (The average rainfall for the month was 5.41 inches, having been exceeded in September but once, viz, in 1884, when an average rainfall of 8.29 inches was reported.) Light to killing frosts were quite general on the 15th and 27th, and in many sections of the Northern States the temperature fell to freezing or below. Frost warnings were issued to cranberry growers on the 14th and 27th. Reports received from the growers showed temperatures ranging from 26° to 29°, with moderate to heavy frosts in the 15th in the bogs. On the 27th frost was general, with temperatures from 24° to 26° on the bogs. The warnings were timely and of benefit to cranberry interests.—*J. W. Smith, District Forecaster.*

CHICAGO FORECAST DISTRICT.

The storm from the southwest reached Lake Michigan by the morning of the 2d, and then passed very slowly eastward, causing brisk to high winds. Several wrecks occurred on Lake Superior, the principal one being that of the *Sevana*, a large steamship, the master of which mistook the Raspberry Island light for that of the Sand Island light and consequently ran upon the reef. The only other storm of consequence reached the Lake region on the morning of the 19th, and passed thence to the northward of Lake Superior without causing any material damage.

Frost warnings were issued for the lowlands of Minnesota and Wisconsin on the 2d, 3d, 4th, and 5th in advance of the cold weather which overspread the Northwest, but the weather continued cloudy and the temperature did not quite fall to the frost point in the States specified. Special attention was given to the prediction of frost in the cranberry marshes of Wisconsin, and the predictions of frost for the balance of the month were completely verified. Warnings were issued on the 12th, and they were followed by a minimum temperature of 26° and 30° at Mather and Grand Rapids, Wis., respectively; again on the 22d the warning was followed by freezing temperature on the marshes. Warnings on the 24th preceded low temperatures over the entire upper Lake region. The minimum in the marshes near Grand Rapids fell as low as 22°.—*H. J. Cox, Professor and District Forecaster.*

LOUISVILLE FORECAST DISTRICT.

There were no marked disturbances during the month. The weather was mostly dry and warm, with a few scattered rain

periods of short duration and one cool spell from the 3d to the 7th and on the 26th on which latter date light frost occurred in the eastern part of Kentucky.—*F. J. Walz, District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.

Weather conditions were moderate until the 26th, when a general low pressure area appeared in the Gulf of Mexico. From the 26th to the evening of the 28th the disturbance was apparently moving from the central Gulf toward the northwest, and on the morning of the 29th the storm-center moved into Louisiana. Although the storm did not exhibit specially severe features, high winds and high tides prevailed along the central Gulf coast, and shipping remained in port until advised by the Weather Bureau that danger had passed. Public opinion is that the warnings prevented much damage. The New Orleans Item of September 30, 1905, remarks in connection with this storm as follows:

The warnings of the United States Weather Bureau have been, as usual, exceptionally accurate and timely. All shipping interests heeded the warnings and remained in port until advised that all danger had passed. In such instances the value of the warnings to the shipping and commercial interests can not be estimated. The money value of the property saved in such a case is doubtless greater than that expended in the operation of the Weather Bureau for an entire year. It is a noteworthy fact that no storms have occurred in recent years without timely warnings, so efficient has the weather service become in this work.

I. M. Cline, District Forecaster.

DENVER FORECAST DISTRICT.

The month was characterized by mild, pleasant weather. Timely warnings were issued for the sharp falls in temperature and killing frosts that occurred during the closing days, and for most of the light frosts that occurred earlier in the month.—*F. H. Brandenburg, District Forecaster.*

SAN FRANCISCO FORECAST DISTRICT.

The month was one of normal conditions and little rain fell, except in the southern portion of the State. On the 26th conditions were favorable for a rapid southerly movement of a depression over Washington; the movement was, however, along a line farther east than anticipated, in fact, on the eastern slope of the Sierra Nevada rather than on the western slope. Warnings were issued to raisin growers and others interested. Showers fell in the central valleys of California, but not along the coast. Rain fell in the southern mountains of California, and would have injured drying crops but for warnings sent on the 27th and night of the 28th.—*A. G. McAdie, Professor and District Forecaster.*

PORTLAND FORECAST DISTRICT.

The fall rains began in northwestern Washington on the 7th, and on the 12th showers and thunderstorms in western Oregon, Washington, and northern Idaho checked forest fires that had been burning for some time. During the last half of the month frost occurred frequently in eastern Oregon, eastern Washington, and Idaho, for all of which timely warnings were issued. Storm warnings for moderate gales were issued on the 16th, 19th, 25th, and 27th.—*E. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

The only feature of special interest in connection with the work of the River and Flood Service during the month was the flood in the Missouri River east of Kansas City, Mo., and in the Mississippi River from Alton to Cairo, Ill., a very unusual occurrence for the time of the year, and an absolutely unprecedented one with regard to the rapid rise of the water. The flood was not of great magnitude, but coming, as it did, at a time of the year when nothing but the usual seasonal decline was expected, it caused a considerable amount of damage to property that was thought to be secure from loss by water.

The flood was caused by the heavy rains from the 15th to

19th, inclusive, over eastern Kansas, Missouri, and southern Illinois, but especially over Missouri. At Boonville, Mo., 12.98 inches of rain fell during this period, while an immense amount of water also poured in from the tributaries from the Ozark Mountains. At Chester, Ill., there was a downpour on the 16th and 17th, 8.06 inches of rain falling in 20½ hours. The preliminary warnings of the flood were issued on the 16th and 17th, and these were followed on the 18th by specific warnings of danger-line stages. The following report of this flood was prepared by Mr. E. H. Bowie, Local Forecaster in charge of the U. S. Weather Bureau, St. Louis, Mo.:

Floods, unprecedented both for the season of the year and for the rapidity of the rising waters, occurred in the Missouri River and tributaries east of Kansas City and in the Mississippi River at St. Louis during the second decade of September, when all records for high water in the months succeeding July were broken for the stations at Boonville, Hermann, and St. Louis.

These floods had their inception in phenomenally heavy rains during the period from September 15 to 19, inclusive, and followed immediately after the downpour during the 24 hours ending at 7 a. m., September 17. The following table gives the daily rainfall during September 15-19 at a number of stations in the St. Louis district for the 24 hours ending at 7 a. m.:

Stations.	Date.				
	Sept. 15.	Sept. 16.	Sept. 17.	Sept. 18.	Sept. 19.
	Inches.	Inches.	Inches.	Inches.	Inches.
Kansas City, Mo.....	2.92	2.04	0.59	1.66	0.46
Oseola, Mo.....	1.30	0.00	0.32	0.00	0.48
Albany, Mo.....	0.18	0.70	0.90	3.00	0.50
Trenton, Mo.....	0.97	2.00	1.34	0.45	0.79
Glasgow, Mo.....	2.87	0.00	3.74	0.00	1.20
Jefferson City, Mo.....	1.05	1.90	5.70	0.01	0.82
Boonville, Mo.....	2.34	1.46	6.70	1.70	0.78
Warrenton, Mo.....	0.05	0.76	2.65	0.01	1.44
Hermann, Mo.....	0.12	0.70	3.40	T.	1.52
Grafton, Ill.....	0.04	0.00	1.97	0.73	8.00
St. Louis, Mo.....	T.	T.	3.22	T.	0.25
Ironton, Mo.....	T.	0.00	5.42	0.13	0.34
Arlington, Mo.....			6.00		
Chester, Ill.....	0.00	0.00	8.06	0.00	0.22

During the 24 hours following the rainfall recorded at 7 a. m. of the 17th rapidly rising water prevailed in all of the tributaries of the Missouri east of Kansas City, and unprecedentedly rapid rises were reported from Boonville and Hermann. These floods washed away a number of bridges on the smaller tributaries and caused a suspension of railroad traffic for several days in the flooded district. A considerable loss of corn and other crops was also caused by the rapidly rising floods.

The Missouri reached a crest stage of 17.5 feet, or within 0.5 foot of the danger line, at Glasgow on the 20th, 22.0 feet or 2.0 above the danger line at Boonville, and 25.4 feet or 1.4 feet above the danger line at Hermann, on the same date. The crest of the flood wave passed St. Louis on the 21st, when the stage was 30.2 feet, or 0.2 foot above the danger line. The most rapid rise in the Missouri occurred during the 24 hours

ending at 7 a. m. of the 17th, during which time the river rose 6.3 feet at Boonville and 9.5 feet at Hermann. At St. Louis the river rose 10.3 feet during the 24 hours ending at 7 a. m. of the 18th, which almost equals the record for rapidity of rise at this point. The greatest recorded 24-hour rise was that of 13.2 feet from January 3 to 4, 1897. Another great 24-hour rise was that of 9.3 feet from February 20 to 21, 1882.

The floods in the Mississippi River between Alton and Chester, aside from inundating bottom lands and destroying the corn crop thereon, caused little damage. At St. Louis previous to the time of the flood the levee was well covered with freight, but precautionary measures prevented loss, except in the cases of several shipments of goods that were piled near the water's edge.

On the morning of the 16th of September the Weather Bureau issued a forecast to the effect that the Missouri and tributaries east of Kansas City and the Mississippi at St. Louis would rise rapidly during the next three days, and on the following morning this forecast was repeated. On the 18th of September flood warnings were issued for the lower Missouri River and the Mississippi River between Alton and Chester. The warning stated that the river at St. Louis would approach the danger line by the night of September 20. The actual stage reached was 0.2 foot above the danger line on the 21st.

The following table shows the daily river stages and 24-hour changes from September 15 to 23, the latter date being the one on which the stage was below the danger line at St. Louis:

Date.	Boonville.		Hermann.		Grafton.		St. Louis.	
	Height.	Change.	Height.	Change.	Height.	Change.	Height.	Change.
September 15.....	8.8	+0.2	9.7	-0.4	8.2	-0.4	11.3	-0.8
16.....	10.6	+1.8	11.2	+1.5	8.2	0.0	11.1	-0.2
17.....	16.9	+6.3	20.7	+9.5	8.8	+0.6	12.9	+1.8
18.....	21.3	+4.4	24.3	+3.6	11.0	+2.2	23.2	+10.3
19.....	21.6	+0.3	25.4	+1.1	13.6	+2.6	27.1	+3.9
20.....	22.0	+0.4	25.4	0.0	15.6	+2.0	29.3	+2.2
21.....	21.3	-0.7	24.6	-0.8	16.4	+0.8	30.2	+0.9
22.....	19.5	-1.8	23.3	-1.3	16.2	-0.2	30.1	-0.1
23.....	17.9	-1.6	21.6	-1.7	15.2	-1.0	29.2	-0.9

Warnings were also issued from Cairo, Ill., for the flood from below St. Louis, Mo., to Cairo, Ill. At Cape Girardeau, Mo., a stage of 30 feet, two feet above the danger line, was reached on the 22d. Considerable corn between Chester and Cairo, Ill., was either lost or injured, but there were no other losses of consequence.

The rivers of the other districts were comparative low, and nothing of more than ordinary interest was noted.

The highest and lowest water, mean stage, and monthly range at 270 river stations are given in Table VI. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—H. C. Frankenfield, Professor of Meteorology.

CLIMATE AND CROP SERVICE.

By Mr. JAMES BERRY, Chief of Climate and Crop Division.

The following summaries relating to the general weather and crop conditions during September are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau; they are based upon reports from cooperative observers and crop correspondents, of whom there are about 3300 and 14,000, respectively:

Alabama.—Generally favorable for maturing and gathering crops, though locally heavy to excessive rains caused some damage and slightly retarded harvesting. Cotton condition generally unsatisfactory, fruitage practically ceased by 15th; damage by rust, shedding, and boll rot ceased by about 20th, too late for crop to recover; bolls opened rapidly, many prematurely; crop about half gathered by close of month, indicating comparatively light yield. Corn and minor crops advanced well, continuing to make fairly good yields.—F. P. Chaffee.

Arizona.—The rainfall was in excess; temperature normal. Killing frost occurred in the mountain districts on the 18th and 30th. Grain harvest was completed in the north-central counties by the 15th; corn and alfalfa cutting in progress over the central section at the end of the month. The snowfall over the San Francisco range, measuring 2.0 inches, on the 29, was the earliest on record. Fruit and garden truck yielded well. There was an ample supply of water. Range feed deterior-

ated over the southwest. Stock generally healthy and fat.—L. N. Jesunofsky.

Arkansas.—Temperature and precipitation slightly above normal. Cotton deteriorated generally during the month; considerable damage by worms, rust, and shedding; opening slowly in some sections, more rapidly in others; picking more general, but not progressing very rapidly; at close of month amount picked ranged from 5 to 25 per cent. Early corn gathered, yield light, not up to earlier expectations; late corn doing fairly well, but will not make a full crop, total failure in some localities. Sweet and Irish potatoes doing well, having been benefited by rains last week of month. Apples all gathered; yield light, quality inferior.—Edward B. Richards.

California.—The temperature and rainfall were slightly below normal, but conditions were very favorable most of the month for ripening grapes and late fruits, raisin making, fruit drying, and general farm work. Light rains at intervals caused no damage, except to unprotected raisins and drying fruits in portions of the south. As a rule the weather forecasts were heeded, raisins were stacked, and the loss was nominal. The first snow of the season fell in the Sierra Nevada on the 23d.—Alexander G. McAdie.

Colorado.—Conditions were generally favorable, notwithstanding damaging frosts on the 18th and 19th in the south-central division and western valleys. Harvesting of grain was nearly finished; yield of small